statistics for informed decision making
Addressing cross cutting issues for SPPI’s

Matt Berger, ABS

22nd Voorburg Group, Seoul, Korea, 2007
Why are we here?

- Establishing internationally comparable methodologies for service sector GDP
- Emphasis on SPPI’s, classifications and turnover surveys
  - And bringing them together for GDP
Service Industry Statistics

- Unique services tailored to individual customers

- Pricing *mechanisms* that don’t readily reflect the service delivered
  - How establishments bill their customers

- Tools & techniques used for goods don’t always work
  - Different methods needed
The business of statistics
Constant balance required
Balancing conflicting priorities

- Time, $ £ ¥ €
Balancing conflicting priorities

- Time, $ £ ¥ €

- Final use of SPPI
Balancing conflicting priorities

- Time, $ £ ¥ €
- Final use of SPPI
- Underlying conceptual model
Balancing conflicting priorities

- Time, $ £ ¥ €
- Final use of SPPI
- Underlying conceptual model
- Too much weight conceptually means survey never delivers
- Time, cost, respondent burden, real data quality
Balancing conflicting priorities

- Time, $ £ ¥ €
- Final use of SPPI
- Underlying conceptual model

- Too little weight conceptually means survey delivers wrong result
  - Unfit for purpose
Wiesbaden 2006

- Common issues across different service types
- Need to articulate issues upfront
  - Rather than reiterate for each industry
- Need to discuss from the perspective of *Service Sector GDP*
Topics covered

- Industry vs. Product
- Exports
- Time based measures
- Challenge when confronted with new technology
- Bundling & Multi-modal solutions
A word on examples

- Examining *cross cutting issues*
- Discussion initiated by Road Freight and Management Consultancy from 2006
- Considering IT this year
- Examples will be based on services that best illustrate the problem – and include other service types
Product or Industry?

• Should we measure all the activities of establishments classified to an industry
  – Regardless of what the activities are?

• Should we measure specific activities
  – Regardless of which industry actually delivers them?
Example: consider two establishments

- **Management Inc.**
  - HR management services
  - Financial management services
  - Security broking and fund management
  - Insolvency and receivership management
  - Accounting and bookkeeping services
  - Legal representation in quasi-judicial tribunals
  - Executive search services

- **Arbeit Inc.**
  - Executive search services
  - Employment agency
  - HR management services
  - Supply of office support personnel
  - Market research
  - Marketing management consultancy services
  - Data processing
Industry: Management Consultancy Services

- Management Inc.
  - HR management services
  - Financial management services
  - Security broking and fund management
  - Insolvency and receivership management
  - Accounting and bookkeeping services
  - Legal representation in quasi-judicial tribunals
  - Executive search services

- Arbeit Inc.
  - Executive search services
  - Employment agency
  - HR management services
  - Supply of office support personnel
  - Market research
  - Marketing management consultancy services
  - Data processing
Industry: Employment Placement

- **Management Inc.**
  - HR management services
  - Financial management services
  - Security brokerage and fund management
  - Insolvency and receivership management
  - Accounting and bookkeeping services
  - Legal representation in quasi-judicial tribunals
  - Executive search services

- **Arbeit Inc.**
  - Executive search services
  - Employment agency
  - HR management services
  - Supply of office support personnel
  - Market research
  - Marketing management consultancy services
  - Data processing
Product: Management Consultancy

- **Management Inc.**
  - HR management services
  - Financial management services
  - Security broking and fund management
  - Insolvency and receivership management
  - Accounting and bookkeeping services
  - Legal representation in quasi-judicial tribunals
  - Executive search services

- **Arbeit Inc.**
  - Executive search services
  - Employment agency
  - HR management services
  - Supply of office support personnel
  - Market research
  - Marketing management consultancy services
  - Data processing
Product: Employment Placement

- **Management Inc.**
  - HR management services
  - Financial management services
  - Security broking and fund management
  - Insolvency and receivership management
  - Accounting and bookkeeping services
  - Legal representation in quasi-judicial tribunals
  - Executive search services

- **Arbeit Inc.**
  - Executive search services
  - Employment agency
  - HR management services
  - Supply of office support personnel
  - Market research
  - Marketing management consultancy services
  - Data processing
What should we do?

- Measuring different things
- For GDP SNA93 recommends supply use framework
- Supply use framework requires SPPI’s be product based
  » National agencies may have additional uses for Industry SPPI’s
Why does this arise?

- Ideally, define units such that each establishment only undertakes one activity

- Unrealistic ideal
  - Horizontal & vertical diversification
  - Similar production functions for different services
  - Different services often produced simultaneously
When can we substitute industry and products SPPI’s?

- If individual products are produced by only one industry, and the industry produces no other products

- If price movements for secondary products align with those of primary products
  - And both move according to supply & demand rather than the industry that produces them
Why might this cause problems?

- Some services require specialist labour inputs
  - Different service products move differently even within the same industry

- Price discrimination is a key feature of service sector
Exports

- Distinction between resident and non-resident units crucial to measurement of GDP

- Export is the purchase of residential output by non-resident unit

- Not defined by *where* the activity takes places
Why does this arise?

- GDP is concerned with the measurement of all output
  - Not just business to business
  - Not just resident to resident

- Scope of SPPI’s often B to B
  - Or if not, only concerned with domestic

- SPPI’s need to include exports
Why might this cause problems?

- Prices may move differently for export markets
  - Potential bias if excluded

- “Customer substitution bias”
  » “Outlet substitution” in CPI

- Volatility if observed data is changing mix of domestic/exports
Assessment needed

- Size of exports relative to size of total output
- Market behaviour
  - Price setting
- Ignoring exports assumes that the export market behaves identically to domestic market
Time based methods

- Methods based on working time
  - Hourly charge out
  - Turnover / hours worked
  - Models including significant proportions of time spent

- Frequent use in many SPPI’s

- Known to be biased
Why do NSO’s use time based methods?

- Service output cannot be readily defined
  - Measure instead in terms of key inputs

- Service varies with different customers
  - Use a model, with time spent a significant component

- Industry uses the pricing mechanism
  - Bills for service not fee per hour

- Compliance cost of other methods
The bias from time based methods

- Time based method is a compromise
  - Equates “service” with “time spent on service production”
  - Underlying assumption does not allow for changes in labour productivity

- For Services GDP, equivalent to saying that volume of output is equal to hours worked
  - Sector never grows except through more workers or same workers working longer hours
Example: An Architect

- Service is “design of a building”

- In year 0
  - Architect produces 12 building designs per year
  - Purchasers pay $9,000 each
    - Total revenue $108,000
  - 150 hours per design
Example: An Architect

- In year 1, uses new process
  - Computer Assisted Design (CAD)

- In year 1
  - Now produces 15 building designs per year
  - Purchasers still pay $9,000 each
    - Total revenue $135,000
  - CAD means 120 hours per design
What is the change in volume?

- Architect has increased output from 12 to 15 designs
- Volume has increased 25%
- But if we didn’t know the number of building designs, how would national accountants derive this change from price and revenue data?
Using fee for service

- **Year 0**
  - Turnover $108,000
  - Price $9,000

- **Year 1**
  - Turnover $135,000
  - Price $9000

\[ V^0 = P^0 Q^0 \]
\[ V^1 = P^1 Q^1 \]
\[ Q^1 \frac{V^1}{Q^0} = \frac{P^1}{P^0} \]
\[ \frac{135,000}{108,000} = \frac{9,000}{9,000} = 1.25 \]
\[ \Delta Q = 25\% \]
How might a time based method work here?

- Total hours worked
  = 12 designs by 150 hours/design
  = 1,800 hours

- Total hours worked
  = 15 designs by 120 hours/design
  = 1,800 hours

- Realised revenue per hour
  =$108,000/1,800
  =$60

- Realised revenue per hour
  =$135,000/1,800
  =$75
Using time based method

- Year 0
  - Turnover $108,000
  - Price $60/hour
- Year 1
  - Turnover $135,000
  - Price $75/hour

\[
V^0 = P^0Q^0 \\
V^1 = P^1Q^1 \\
Q^1 = \frac{V^1}{V^0} \frac{P^1}{P^0} \\
\frac{135,000}{108,000} = \frac{75}{60} \\
\Delta Q = 0\% 
\]
Detailed example

<table>
<thead>
<tr>
<th></th>
<th>Year 0</th>
<th>Year 1</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price per design</td>
<td>9000</td>
<td>9000</td>
<td>9000</td>
</tr>
<tr>
<td>Designs per year</td>
<td>12</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Turnover</td>
<td>108000</td>
<td>135000</td>
<td>135000</td>
</tr>
<tr>
<td>Hours per year</td>
<td>1800</td>
<td>1800</td>
<td>1800</td>
</tr>
<tr>
<td>Price per hour</td>
<td>60</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>Turnover change</td>
<td></td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td>Volume change</td>
<td></td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td>Price change</td>
<td></td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Change in price per hour</td>
<td></td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td>Derived volume change</td>
<td></td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>
Time based methods are biased

- If productivity improves
  - Price measures are biased upwards
  - Volume measures are biased downwards
  - Not mitigated through use of “staffing levels”
    - Although ignoring levels of expertise is worse
Would productivity measures help our architect?

- If some productivity measure indicated the change in production function (12 designs to 15 for same labour input) then a **quality adjustment** could be applied to the price index
  - Resource cost approach

- Volume measure would then be **unbiased**
What should we do?

- Time based methods *will* be used by NSO’s
  - Compliance cost

- What can be done to mitigate the bias?

- Inform users of areas of risk!
Guidelines

- Do not use labour input costs for SPPI’s
  - Better for national accountants to use labour price indexes

- Construct SPPI’s from realised rates
  - **Actual** revenue per hour, not a forecast

- Avoid time based methods where subcontracting is used

- Define “bands of expertise”
  - More than just “staffing level”
Detecting changes in productivity

- Changes in roles, duties, outputs of staff
  » Such as you might do for a labour price index
- Introduction of new technology

- Dedicated instruments
  - Extra questions on SPPI survey
    » Burden, cost
  - Stand alone questionnaire
  - Other sources
    • Government agencies, industry associations
      » Beware circularity

- Apply quality adjustment to reflect change in productivity
New technology

- Technology changes the production function
  - More output for same inputs

- Technology can also change the product
  - Different service

» Factors aside from technology can do this too of course, and this argument holds there as well
Why is this a problem?

- Change in product is a quality change
- Quality changes should appear as changes in volume in the national accounts
- Need to price to constant quality
Example

- Architect adopting CAD
- Blueprint design
- 3D model with interactive virtual tour
- Are these the same?
What should we do?

- Detect changes in technology
  - Or other influences on productivity

- Assess whether service is modified
  - Require expert assessment
Bundling

• Pricing *mechanism*

• Include many services on one bill

• Differences each period
  – Change in mix of customers
  – Change in mix of services

• Need technique for measuring prices & price change
Component Cost

- Establish a representative base model service
  - May be hypothetical
  - Components need to be real

- Price individual components each period

- Price for service is aggregate of observed prices
### Example: Telecommunications

**Box 3. An example of component pricing**

Pricing of local telephone services (called "unit value method") in the USA's PPI.\(^{37}\)

Average number per access line (weight) in the base period is obtained by dividing the total number of units for each type of charges by the total number of access lines.

Average revenue per unit in period \(t\) is obtained by dividing revenues for each type of charges by the total quantity used of each charge.

Weighted revenue in period \(t\) is calculated by multiplying average number per access line by average revenue per unit. The price is the sum of weighted revenues.

<table>
<thead>
<tr>
<th>Type of charge</th>
<th>Average number per access line (a)</th>
<th>Average revenue per unit (b)</th>
<th>Weighted revenue (a) x (b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access line</td>
<td>1.000</td>
<td>26.7530</td>
<td>26.7530</td>
</tr>
<tr>
<td>Usage charges based on time:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak minutes</td>
<td>162</td>
<td>0.2589</td>
<td>41.9418</td>
</tr>
<tr>
<td>Off-peak minutes</td>
<td>133</td>
<td>0.0824</td>
<td>10.9592</td>
</tr>
<tr>
<td>Roaming minutes</td>
<td>10</td>
<td>0.9722</td>
<td>9.7220</td>
</tr>
<tr>
<td>Usage charges other than time:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landline, per call</td>
<td>2</td>
<td>0.1500</td>
<td>0.3000</td>
</tr>
<tr>
<td>Other charges, daily rate</td>
<td>1</td>
<td>1.5000</td>
<td>1.5000</td>
</tr>
<tr>
<td>Features/Options and feature packages:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Custom calling package</td>
<td>0.65</td>
<td>3.4600</td>
<td>2.2400</td>
</tr>
<tr>
<td>Call waiting</td>
<td>0.20</td>
<td>4.8500</td>
<td>0.9700</td>
</tr>
<tr>
<td>Call forwarding</td>
<td>0.10</td>
<td>5.1500</td>
<td>0.5150</td>
</tr>
<tr>
<td>3-way conference</td>
<td>0.05</td>
<td>5.7500</td>
<td>0.2875</td>
</tr>
<tr>
<td>No answer transfer</td>
<td>0.10</td>
<td>4.2500</td>
<td>0.4250</td>
</tr>
<tr>
<td>Voice messaging</td>
<td>0.20</td>
<td>4.8000</td>
<td>0.9600</td>
</tr>
<tr>
<td>Total (Price in period (t))</td>
<td></td>
<td></td>
<td>96.5825</td>
</tr>
</tbody>
</table>
**Example: “Logistics Solution”**

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
<th>Average revenue per unit</th>
<th>Weighted revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery of 40FE from Sydney (Port Jackson) to Canberra terminal</td>
<td>1</td>
<td>$820</td>
<td>$820</td>
</tr>
<tr>
<td>Transport of palette of beer from Canberra terminal to Supermarket</td>
<td>72</td>
<td>$12</td>
<td>$864</td>
</tr>
<tr>
<td>distribution centre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transport of palette of beer from Canberra terminal to Liquor wholesaler</td>
<td>5</td>
<td>$19</td>
<td>$95</td>
</tr>
<tr>
<td>Total price in period $t</td>
<td></td>
<td></td>
<td>$1,779</td>
</tr>
</tbody>
</table>
Problem?

• Suitable when components are all of the same service type
  – And fixed model service is representative

• What happens when “representative service” can’t be defined within service type?
**More problematic example: “Logistics Solution”**

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
<th>Average revenue per unit</th>
<th>Weighted revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery of 40FE from Sydney (Port Jackson) to Canberra terminal, including Stevedoring in Sydney and storage in Canberra for up to 2 weeks</td>
<td>1</td>
<td>$2005</td>
<td>$2005</td>
</tr>
<tr>
<td>Transport of palette of beer from Canberra terminal to Supermarket distribution centre</td>
<td>72</td>
<td>$12</td>
<td>$864</td>
</tr>
<tr>
<td>Transport of palette of beer from Canberra terminal to Liquor wholesaler</td>
<td>5</td>
<td>$19</td>
<td>$95</td>
</tr>
<tr>
<td><strong>Total price in period t</strong></td>
<td></td>
<td></td>
<td><strong>$2,964</strong></td>
</tr>
</tbody>
</table>
The Problem

- Component cost is useful if service can be defined within a service classification

- Business operations don’t always align with classifications

- Pricing mechanisms cross different business operations
Solutions?

- Define models to split our components into **fixed** different service types
  - Bills approach
    - Use of respondents internal pricing models

- Ongoing pricing might not be feasible
  - Pricing mechanisms may only exist for the aggregate

- Estimation of splitting factors
  - Reliability?
  - Ongoing representivity?
  - Burden?
**Example with well defined components: “Logistics Solution”**

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
<th>Average revenue per unit</th>
<th>Weighted revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stevedoring for beer shipment in Port Jackson</td>
<td>1</td>
<td>$800</td>
<td>$800</td>
</tr>
<tr>
<td>Delivery of 40FE from Sydney (Port Jackson) to Canberra terminal</td>
<td>1</td>
<td>$820</td>
<td>$820</td>
</tr>
<tr>
<td>Storage of palette of beer at Canberra Depot, 2 weeks</td>
<td>77</td>
<td>$5</td>
<td>$385</td>
</tr>
<tr>
<td>Transport of palette of beer from Canberra terminal to Supermarket distribution centre</td>
<td>72</td>
<td>$12</td>
<td>$864</td>
</tr>
<tr>
<td>Transport of palette of beer from Canberra terminal to Liquor wholesaler</td>
<td>5</td>
<td>$19</td>
<td>$95</td>
</tr>
</tbody>
</table>

**Total price in period t**  
$2,964
Example with estimated splitting factors: “Logistics Solution”

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
<th>Average revenue per unit</th>
<th>Split factor</th>
<th>Weighted revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery of 40FE from Sydney (Port Jackson) to Canberra terminal, including Stevedoring in Sydney and storage in Canberra for up to 2 weeks</td>
<td>1</td>
<td>$2005</td>
<td>0.40</td>
<td>$2005</td>
</tr>
<tr>
<td>Stevedoring</td>
<td></td>
<td></td>
<td></td>
<td>802</td>
</tr>
<tr>
<td>Delivery</td>
<td></td>
<td></td>
<td>0.40</td>
<td>802</td>
</tr>
<tr>
<td>Storage</td>
<td></td>
<td></td>
<td>0.20</td>
<td>401</td>
</tr>
<tr>
<td>Transport of palette of beer from Canberra terminal to Supermarket distribution centre</td>
<td>72</td>
<td>$12</td>
<td></td>
<td>$864</td>
</tr>
<tr>
<td>Transport of palette of beer from Canberra terminal to Liquor wholesaler</td>
<td>5</td>
<td>$19</td>
<td></td>
<td>$95</td>
</tr>
<tr>
<td>Total Road Freight in period t</td>
<td></td>
<td></td>
<td><strong>Delivery 802 + 864 + 95</strong></td>
<td>$1,761</td>
</tr>
<tr>
<td>Total price in period t</td>
<td></td>
<td></td>
<td></td>
<td>$2,964</td>
</tr>
</tbody>
</table>
More work required here

- How robust will this be?
  - And how much burden does this introduce?

- Can the Stevedoring and Storage estimates be used in their respective indexes?
  - Product SPPI’s
    » Timing?

- Can our CPI colleagues help?
  - Bundling of “phone, gas, water, internet” is the same example
Multi-modal solutions

- One service is consumed (used) in the production of another service
  - Example: Road Freight uses Sea Freight (Ferry)

- Intermediate consumption when provided by another establishment

- Production on own-account when provided by same establishment
What should we do?

- Supply Use approach to National Accounts requires measures of both outputs and intermediate consumption.

- Road Freight SPPI should still include the road freight when it uses the ferry.
  - Provided ferry service not produced on own account.

- Sea Freight should also include the ferry.
Double counting?

- Any combined SPPI measuring of both sea and road freight will include the ferry component twice
  - Once as part of Road Freight
  - Once as part of Sea Freight

- Combined SPPI has double counting!
Service Sector GDP

- SPPI for **national accountants** requires measure of **both components**
  - Double counting does not occur because the ferry service is measured as intermediate consumption
  - Use of SPPI occurs at product level, not aggregate level

- Recommendation is based on **needs of national accountants**

- Other uses require different solution
  - Service price index constructed on net sector approach
Summary

- Product SPPI’s over industry for GDP
  - Industry useable under assumptions of price certain behaviour

- Exports in scope of SPPI’s
  - Importance determined by size and price setting mechanisms
Summary

- Time based methods are biased
  - Need to account for productivity change

- New technology can change product itself as well as production function
Summary

• Bundling can be solved via component cost
  – Burden still an issue
    » More work needed

• Services used as intermediate consumption still need to be measured for GDP
  – Double counting only an issue for other uses